Committee on Resources

Subcommittee on Fisheries Conservation, Wildlife and Oceans

Statement

Steller sea lions and pollock fisheries in western Alaska

Statement submitted to:

Subcommittee on Fisheries Conservation, Wildlife & Oceans

Committee on Resources
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by

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"...although we might wish to manage wild marine animals or their environment, as yet we don't know how. What perhaps we humans can manage are our own activities which affect the marine mammals, to our own ultimate benefit or harm."

S.J. Holt (1978, p. 263)

Steller sea lions and pollock fisheries in western Alaska

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Introduction

I have been conducting research on pinnipeds (fur seals, sea lions, walrus and true seals) since 1969. I received a PhD (Guelph) in 1974 and a Dr philos (Oslo) in 1988, both for research on seals. From 1973-1996 I was a professor in the Department of Zoology, University of Guelph. Since 1990, I have been executive director of the International Marine Mammal Association, a not-for-profit organization concerned with the conservation of pinnipeds worldwide. I am currently a member of the World Conservation Union's Seal Specialist Group, and the Pinniped Fishery Interaction Task Force on the Sea Lion/Steelhead Conflict

at the Ballard Locks, Seattle. I have been involved in a number of meetings and symposia on the potential interactions between pinnipeds and fisheries, including workshops in South Africa, Canada, and the United States. I also co-edited the book *Marine Mammals and Fisheries* (George Allen & Unwin, 1985).

In March 1991, I was an invited participant in the "Is it Food?" workshop organized by the Alaska Sea Grant College Program and held at the University of Alaska Fairbanks (Anon. 1993). That workshop addressed the question: "Is food availability the key to declining marine mammal and seabird populations in the northern Gulf of Alaska and Bering Sea?" The workshop summary (Anon. 1993) concluded that "food availability seems to be the most plausible explanation for observed declines of pinnipeds and piscivorous birds in the region" and that "nesting birds and juvenile mammals [such as juvenile Steller sea lions] seem to be especially vulnerable to local changes in the availability of quality prey" (Dearborn 1993, p. iv). It went on to note that "the more detailed the explanation of the causes of reduced food availability, whether it be focused on climate change, ecosystem processes, or anthropogenic activity [e.g. commercial fishing], the less unified the support" (Dearborn 1993, p. iv).

Later that year I submitted an affidavit concerning the likely impacts of the pollock fisheries on Steller sea lions in the 1991 sea lion litigation (Lavigne 1991). In that affidavit I argued that the National Marine Fisheries Service's (NMFS) conclusion that the 1991 pollock catch was not likely to jeopardize the continued existence or recovery of Steller sea lions in the Gulf of Alaska was not scientifically justified (Lavigne 1991). At the time, NMFS acknowledged that the commercial pollock fishery may adversely affect the Steller sea lions' health and reproduction, but concluded that no harm was likely because the causal connection, hypothesized by NMFS' own and outside scientists, had not been definitively proven. I argued that NMFS' conclusion was scientifically unjustified because the process of "science" does not (and cannot) prove hypotheses; rather, it attempts to reject them.

I further noted that the available evidence (including that reviewed at the Is it food? workshop) was insufficient to reject a causal relationship between the Gulf of Alaska (GOA) pollock fishery and the sea lion decline, and that neither NMFS nor its scientists pointed to any contrary data, analyses or competing hypotheses to explain adequately the decline in the sea lion population (Lavigne 1991).

As a result of the above considerations, I was unable to reject the hypothesis that increasing the harvest of pollock in the Gulf of Alaska might jeopardize the [then] "threatened" Steller sea lion. I further concluded that the only means of insuring that there would be no likelihood of jeopardy to the sea lion population, as the Endangered Species Act required, was to avoid actions that might diminish the availability of prey to the species.

Between 1991 and 1998, the pollock fishery continued, increasingly within designated critical habitat for Steller sea lions and increasingly during the winter months (Anon. 1998). In 1997, the status of the western population of Steller sea lions in Alaska was reclassified from threatened to endangered under the Endangered Species Act (ESA) (Anon. 1998).

NMFS' 1998 Biological Opinion (Anon. 1998, p. 114) now concludes: that after reviewing the current status of the Steller sea lion, the environmental baseline for the action areas, the effects of the proposed 1999-2002 Bering Sea/Aleutian Islands (BSAI) and GOA pollock fisheries, and the cumulative effects, that these pollock fisheries, as proposed, are likely to jeopardize the continued existence of the western population of Steller sea lions and adversely modify its habitat.

In March 1999, Mr Douglas A. Ruley, Earthjustice Legal Defense Fund, asked me to review materials

related to Steller sea lions in the North Pacific, including the latest Biological Opinion. I was subsequently invited by the North Pacific Fishery Management Council to make a presentation on 27 April before the panel of independent scientists established to review the scientific basis for the recent Biological Opinion and other information relative to Steller sea lions and the pollock fisheries off Alaska. Shortly thereafter, I was invited to appear before you today.

In reviewing the 1998 Biological Opinion and related documents, I took essentially the same approach I followed in 1991. I treated the NMFS' current conclusions (outlined above) as hypotheses and asked the question: Are there any data, analyses, or interpretations that would permit me to reject these hypotheses? In short, I was unable to reject either hypothesis (Lavigne 1999).

I then reviewed the Reasonable and Prudent Alternatives (RPAs) included in the Biological Opinion. In my opinion, the proposed RPAs are unlikely to avoid jeopardy and adverse habitat modification for endangered Steller sea lions, because they do not remedy the factors that led NMFS to reach its conclusions of jeopardy and adverse modification (Lavigne 1999).

Below, I address the various issues about which you have asked witnesses to testify.

1. The process used to develop the jeopardy finding

In preparing its Biological Opinion, NMFS appears to have followed the process required by section 7 of the ESA. It performed a thorough review of the available information and, in arriving at its conclusions, generally used the best scientific and commercial data available.

There was only one instance where, in my opinion, NMFS did not use the best available scientific information. Under section 2.2.4.4 Allowance for other marine predators (Anon. 1998, p. 38), the Opinion uses estimates of daily ration from Perez (1990) and Perez *et al.* (1990) to estimate consumption rates for Steller sea lions. Based on work conducted in my former laboratory at the University of Guelph (e.g. Innes *et al.* 1987, Lavigne *et al.* 1986), it is my opinion that the approach outlined in Perez *et al.* (1990) will almost certainly overestimate the daily energy requirements of Steller sea lions (also see Anon. 1991). In this instance, however, it is unlikely that any revision of the Biological Opinion to correct for this possible oversight would change its conclusions.

2. The Biological Opinion

In my opinion, the best available scientific and commercial data support "a conclusion that the pollock fisheries compete with the western population of Steller sea lions." This does not mean -- I must emphasize -- that such competition has been demonstrated conclusively (see Anon. 1998, p. 99). Rather it means that the data and analyses reasonably support that conclusion and I could find no data or analyses that would reject the hypothesis that such competition is occurring.

The major scientific reasons supporting the conclusion that the pollock fisheries, if left unchanged, could reasonably be expected to jeopardize the continued existence of the western population of Steller sea lions are as follows:

- pollock is the major prey item consumed by the western population of Steller sea lions (Anon. 1998, Trites *et al.* 1998); >
- the distribution of the pollock fishery overlaps extensively with the distribution of foraging sea lions

(Anon. 1998); >
- some large scale correlations exist between the decline of Steller sea lions and the increase in the size of the pollock fishery (e.g. Loughlin and Merrick 1989, Trites and Larkin 1992, Trites *et al.* 1998); >
- the coincidental developments in the commercial fisheries in Alaskan waters are an obvious possible contributing factor to the decline of Steller sea lions (Trites *et al.* 1998); >
- the fishery is now concentrated in space and time and overlaps significantly with critical habitat that has been designated for Steller sea lions (Anon. 1998, Marine Mammal Commission 1999).
>
- in the BSAI, specifically, >
- the amount and percent of the BSAI pollock TAC caught in Steller sea lion habitat has doubled since the mid-1980s (Anon. 1998, Marine Mammal Commission 1999); >
- the percent of pollock caught within designated critical habitat increased to as much as 70% between 1992 and 1997 (Anon. 1998, Marine Mammal Commission 1999); >

- pollock fishing effort has increased in fall and winter when pollock are more concentrated within critical habitat (Anon. 1998); >

- Steller sea lions continue to decline (Anon. 1998).
>

- in the GOA, specifically: >
- since 1982, 50-90% of the catch has been taken from Steller sea lion critical habitat (Anon. 1998); >
- the highest removals from critical habitat occur during winter (January) (Anon. 1998, p. 110); >
- Steller sea lions continue to decline (Anon. 1998). >

It is reasonable to conclude, therefore, that:

- local reductions in pollock biomass in space (particularly within critical habitat) and time (particularly during winter) are likely to reduce the availability of pollock to endangered Steller sea lions. >
- in addition, the pollock fishery is likely to have other negative impacts, such as dispersing the remaining fish and altering the behavior of sea lions. >
- the concentration of the pollock fishery in space (critical habitat) and time (winter) is likely to reduce the foraging success of endangered Steller sea lions. >
- the proposed pollock fishery is likely to jeopardize the continued existence of the western population of Steller sea lions. >

A number of the reasons cited above also support the conclusion that the pollock fisheries, if left unchanged, could reasonably be expected to adversely modify the critical habitat of the western population of Steller sea lions. Furthermore, the very presence of the pollock fishery in Steller sea lion critical habitat may adversely modify that critical habitat by opening up the possibility for interference competition between the pollock fishery and the sea lions (Anon. 1998, p. 55), which might reduce (or exclude) access of Steller sea lions to their principal prey species on a local spatial scale at particular times of the year (especially during winter).

The removal of pollock biomass from Steller sea lion critical habitat by the fisheries could also reduce the availability of pollock to Steller sea lions. Such reduction could reduce the foraging efficiency of Steller sea lions due to exploitation competition (Anon. 1998, p. 55) and, if this were to occur, the actions of the fisheries would adversely modify the critical habitat of the Steller sea lion.

3. The Reasonable and Prudent Alternatives

Here I diverge from the views expressed in the Biological Opinion. In preparing its Reasonable and Prudent Alternatives, it seems that NMFS has gone out of its way to minimize impacts on the fishery, rather than maximizing the likelihood of promoting the recovery of Steller sea lions. For me, this is reminiscent of how NMFS has dealt with similar potential conflicts regarding Hawaiian monk seals (*Monachus schauinslandi*) and commercial fisheries in the Northwestern Hawaiian Islands. When faced with such conflict in Hawaii, NMFS has invariably placed the short-term economic interests of the fishery over the longer term interests of the endangered monk seal (Lavigne *in press*). Arguably, this is also what NMFS has done over the past nine years in the case of the Steller sea lion. And while it has now concluded that the pollock fishery might jeopardize the continued existence of the sea lions, it appears, in developing its RPAs, to have been more concerned with minimizing disruption of the fishery than with applying a truly precautionary approach to the management of the endangered Steller sea lion and its food base.

The only way, in my opinion, to insure no jeopardy is to stop fishing, at the very least, within the critical habitat of Steller sea lions. One wonders if even this would be sufficient. Based on the limited information available on Steller sea lion movements and foraging areas, it seems likely that Steller sea lion critical habitat has been conservatively defined and that closing fisheries only within currently designated critical habitat may be insufficient to insure no jeopardy to Steller sea lions as required under the ESA.

4. Adequacy of the National Marine Fisheries Service's (NMFS) scientific research program.

Time has not permitted me to undertake a detailed review of NMFS' scientific research program on both Steller sea lions and walleye pollock. I am certain that NMFS scientists would say that they have tried to devise the best possible research program within the limits of the available funding, given the difficulties of working with a threatened and subsequently endangered species, and the logistical realities of working on sea lions in their remote northern terrestrial and marine environments. I also suspect that they would be the first to admit that the program could have been better, had they had more funding and additional human resources. I would agree with such assessment.

5. How NMFS could improve or expand its current research program

How to improve the scientific information base related to potential interactions between Steller sea lions and walleye pollock was the subject of some discussion at the hearings of the scientific review panel in Seattle last month. I anticipate that the panel's report will offer a number of specific recommendations that your committee might wish to consider.

There are a number of areas where additional scientific information is required to improve the basis for making future determinations on the likely effects of the pollock fishery on endangered Steller sea lions. The current Biological Opinion is to a large extent determined by the current designation of critical habitat and the view that the winter period is particularly "harsh" for Steller sea lions. It is from these considerations that it seems likely that the concentration of the pollock fisheries in designated critical habitat is *likely* to jeopardize the continued existence of the western population of Steller sea lions and adversely modify its habitat. These considerations point, in my opinion, to several areas where NMFS could improve or expand upon its current research program.

5.1 Critical habitat. In my opinion, more research is required to delineate better the critical habitat of Steller sea lions. Given what is already known about their daily and seasonal movements at sea, I suspect that the currently designated critical habitat grossly underestimates the extent of habitats that are critical to the continued survival and recovery of the western population of Steller sea lions. Further research, using satellite transmitters and time depth recorders, on male and female Steller sea lions of various ages (particularly juvenile animals and lactating females) throughout the entire year, and over several years, will be required to adequately define meaningful critical habitat for Steller sea lions.

5.2 The "harsh" winter period: The current Biological Opinion states (p. 107) that "The winter months are considered to be a period of greater sensitivity of sea lions to lack of available prey and competition. This sensitivity is a function of both the life history of sea lions and **their greater metabolic demands during the harsh winter period**" (emphasis added).

As I pointed out to the review panel last month, this is another area where further research could better inform future Biological Opinions. The most serious potential metabolic problem, and one which might be investigated at least in a preliminary way using heat flow models, has to do with the ability of young, small, lean Steller sea lions to deal with winter temperatures, both on land and in water. They, and possibly lactating females, would be the most vulnerable components of the Steller sea lion population to winter conditions. Lean pups might well find themselves below their lower critical temperatures (e.g. Lavigne *et al.* 1982, Hansen and Lavigne 1997). This would require them to increase their metabolic rates to maintain a constant deep body temperature (homeothermy). Increased metabolic costs in the absence of adequate food resources would put the animals into a classic positive (or run-away) feedback loop, i.e. thin sea lions would have to increase metabolic rate to keep warm and, in the absence of adequate food, they would have to draw on body energy stores, which would make them even thinner, and the process would go on until the animal eventually would succumb to hypothermia. And, of course, throughout this process, lean hungry sea lions would likely spend more time at sea, perhaps venturing farther offshore, in search of food, leaving them increasingly vulnerable to predation (Watts 1996). Both factors, hypothermia and increased risk of predation, could contribute to the apparent increase in natural mortality of juvenile sea lions observed coincident with the population decline.

5.3 Potential effects of the pollock fisheries on endangered Steller sea lions: The current Biological Opinion is based on the view that the concentration of the pollock fisheries in both space (particularly within critical habitat) and time (particularly during the "harsh" winter period) causes local depletion of an important food resource for endangered Steller sea lions (particularly for immature animals, during winter).

This is one area where more scientific and commercial data are critically needed. Data on the abundance of pollock in *specific* areas (and especially within sea lion critical habitat, and during the winter fisheries, if such fishing practices continue) before, during and after commercial fishing of an area would provide quantitative data on the extent to which pollock abundance and, hence, its availability to sea lions, is reduced by the fishery over the time. Continued monitoring after the fishing boats have left an area would provide valuable information on the time course of local depletion and reduced availability of pollock to Steller sea lions.

Also, during the discussions in Seattle last month, there seemed to be some agreement among scientists that an experimental approach to the fishery was really required to learn more about the potential impacts of the pollock fishery on endangered Steller sea lions. The way the fishery has been conducted in recent years provides no new information on the nature of potential interactions between it and Steller sea lions. The view was expressed that the fishery should be managed first with a view to satisfying the no jeopardy or

adverse habitat modification criteria, as required by the ESA. Having met those requirements, the fishery could then be managed in a way designed to provide valuable information on the potential impacts of the pollock fishery on endangered sea lions. By taking an "experimental" approach to the commercial fishery, both the industry and NMFS should be in a better position to evaluate the potential impacts of the fishery on Steller sea lions. Obviously, such an experimental approach would require major changes in how the fisheries are operated and, likely, would have economic consequences for the industry.

Discussion

It is agreed that the western population of Steller sea lions in Alaska has declined over the past 30 years by at least 80 per cent (Anon. 1998). The reason or reasons for the continuing decline are not entirely understood and at least 12 possible factors have been posited as potential explanations for the decline (NRC 1996). Of these 12 factors, two seem to predominate: fishery effects on food availability for Steller sea lions, and long-term ecosystem shifts that have affected food availability for Steller sea lions (e.g. Trites 1998, Trites *et al.* 1999).

NMFS' task, in preparing its Biological Opinion, was not, however, to determine which of these two or other factors are responsible for the decline of Steller sea lions in Alaska. It was simply to express an opinion as to whether the pollock fishery is *likely* to jeopardize the continued existence of the western population of Steller sea lions and adversely modify its habitat. Indeed, under the Endangered Species Act, NMFS must "insure" that the pollock fisheries are not likely jeopardizing sea lions or adversely modifying their critical habitat. Thus the burden of proof is on the fisheries to demonstrate that they are not jeopardizing the species or adversely modifying its critical habitat.

One of the problems facing anyone attempting to evaluate the NMFS' Biological Opinion and its proposed Reasonable and Prudent Alternatives -- whether they be outside scientists or committees like yours -- relates to the wide array of available information, much of which seems to present conflicting views of the problems faced by endangered Steller sea lions. In order to sort through the maze of apparently conflicting information, it may be helpful to remember that, from a scientific perspective, not all sources of information can be considered equal. Some examples:

- Peer-reviewed primary scientific literature, published in independent journals: In most areas of science, the peer-reviewed literature documents the current state of knowledge and is the main source of information.
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- The so-called "grey" literature: This includes papers published by government departments and non-governmental organizations, which usually have not received the benefit of *independent* peer review and have not been accepted for publication in the primary scientific literature. They do not enjoy the same status as primary publications and, in fact, some scientific journals resist referring to such papers precisely because they have not been peer reviewed, and because of their normally restricted distribution and, hence, availability. >

- Reports from meetings: Reports from scientific meetings and workshops often provide useful reviews of topical issues. Many such meetings produce agreed reports that document the nature of the discussion and any conclusions or recommendations arising. But they still represent only the views of the participating scientists. >

- Unpublished reports: Unpublished reports are not normally considered part of the scientific literature. They include drafts of papers that may subsequently be submitted for consideration by a scientific journal, or manuscripts that have actually been submitted and rejected. Reference to such unpublished reports is usually not permitted in the primary scientific literature. >

- Anecdotal reports: Such reports, by scientists and others, are not normally considered to be part of the scientific information base. Nonetheless, such reports might raise interesting questions or hypotheses that could be examined scientifically, >

There is a tendency -- particularly among non-scientists and the media -- to give equal weight to claims arising from all of the above sources of information. Scientists, on the other hand, who are (or should be) sceptical by their very nature, will instinctively treat the information in the various sources above with increasing vigilance as they proceed from peer-reviewed literature to anecdotal reports.

It may be of some use to your committee, therefore, to apply a similar approach in evaluating the scientific information presented to you.

For example, the Biological Opinion (p. 73) refers to a study by Rosen and Trites (*in prep.*). Much has been made of this "study," in newsletters and annual reports of The North Pacific Universities Marine Mammal Research Consortium (NPUMMRC 1996, 1998), and on its World Wide Web site (http://www.marinemammal.org). Its purported results, that captive sea lions fed exclusively on a diet of pollock lose weight, seem to surface in every discussion of Steller sea lions. But, as the Biological Opinion notes, the paper "is not available in written form, but has been reported at meetings of the North Pacific Fishery Management Council and in other public discussions," including the recent meeting of the review panel in Seattle.

The question becomes, therefore, how much credence should be placed on this report? For those of us who have kept pinnipeds in captivity, the results are neither surprising nor particularly interesting. Captive seals often lose weight at certain times of the year, even when being fed a diet of high energy herring. And without the details of the Steller sea lion experiment, at least in the form of an unpublished manuscript, the report amounts to anecdotal information. Numerous unanswered questions remain, such as: how many sea lions were involved in the study, their ages and sexes, when was the study conducted, were the herring and pollock used in the experiment the same size, etc. Until a paper surfaces to address these and other questions, little weight should be placed on the results.

There are several other instances where the waters have been muddied by unconventional scientific practices. A recent example relates to the appearance on the World Wide Web of a manuscript on ecosystem change and the decline of marine mammals in the Eastern Bering Sea (Trites *et al.* 1999). Within days, a magazine article (Drouin 1999) discussing this manuscript appeared, suggesting that the magazine was given access to the manuscript even before it appeared on the web. Contrast this approach with normal scientific practice, where a manuscript is submitted to a peer-reviewed scientific journal, likely revised in light of reviewers comments and then, if deemed acceptable, it would eventually appear in the scientific literature. Only after acceptance or publication would one normally expect to see it featured in the media or in magazine articles. Regardless, at the present time, the manuscript in question remains an unpublished and non-refereed manuscript, and not part of the normal scientific information base.

In evaluating the Biological Opinion, including the RPAs, we are also constrained both by the language of

the ESA and by the realities of how science is conducted. Implicit in much of the literature on Steller sea lions and pollock fisheries is a tendency to amass information in support of a particular conclusion, and to demand convincing evidence or "proof," for example, that the actions of the pollock fishery are jeopardizing the continued existence of endangered Steller sea lions. Amassing evidence in support of any position is, however, antithetical to the scientific method and, ultimately, the "scientific method" is not designed to prove things are true, but rather to disprove them.

Pinnipeds, including Steller sea lions, are aquatic members of the order Carnivora. They evolved in highly productive marine ecosystems and, with the exception of modern monk seals (*Monachus spp.*), virtually all extant species live in relatively cold, productive seas (Lavigne *et al.* 1989). Predators, such as sea lions, have evolved, as Sidney Holt (1982) noted, "to require certain concentrations of food items, distributed appropriately by season and locality. If those concentrations are no longer available," Holt continued, "the marine mammal will have a lessened ability to recover fully from depletion, even if protected, or indeed might not be able to survive at all… Up to a point, it will [acclimatize] to the new conditions -- perhaps by seeking other kinds of food…perhaps by feeding elsewhere than habitually. The ability of an animal…so to [acclimatize]…is however limited."

Considering the Steller sea lion, Holt's comments seem prophetic. Steller sea lions in Alaska are showing signs that the population is short of food. Adult body mass is smaller than in the past; juveniles are smaller and grow more slowly than in the past, and appear to be experiencing high rates of mortality; and the population has been declining for more than 30 years.

The food shortage to Steller sea lions may be explained by two (and possibly more) hypotheses:

) Food is in short supply because of the existence of large pollock and other fisheries operating within the critical habitat of Steller sea lions. (This hypothesis was the only one rated by the National Research Council (1996, p. 145) to have a "high" likelihood of involvement in the decline of Steller sea lions since 1980.);

) Appropriate food is in short supply because of long term environmental changes in the parts of the North Pacific (e.g. Trites 1998, Trites *et al.* 1999).

These two hypotheses are not necessarily mutually exclusive. Let's accept that long term environmental changes in regions of the North Pacific have led to a change in prey availability for Steller sea lions. If this were correct, there is very little managers can do about it. But, if food has become scarce because of such changes, then further depletion of the food base by commercial fisheries should only exacerbate the problem. And the latter possibility is something that managers can attempt to mitigate.

Returning to Holt's earlier comments, we really have no idea of the range of concentrations of food items over which Steller sea lions can acclimatize, and how these need to be distributed appropriately by season and locality to allow sea lions to survive (and hopefully recover) in Alaskan waters. But the only way to insure that the commercial pollock fishery is not likely to cause or exacerbate a food shortage problem, and thereby jeopardize the continued existence of endangered Steller sea lions, is to insure that the fishery does not contribute in any way to reducing the availability of a prey species that is important to the depleted sea lion population. And, the only way to attempt that is to develop RPAs that separate the fishery and the sea lions in space and time in order to minimize the likelihood of future competition.

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